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Fritziana aff. *fissilis* (Miranda-Ribeiro, 1920) (Anura, Hemiphractidae): the first hemiphractid for the state of Rio Grande do Sul, southern Brazil

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Abstract: The first occurrence of *Fritziana* aff. *fissilis* (Miranda-Ribeiro, 1920) in the state of Rio Grande do Sul, southern Brazil, is reported. The records were obtained near the sources of the Rio dos Sinos, municipality of Caraá, and extend the range of the species 140 km south from where it was previously known. The new records also represent the first time a species of the family Hemiphractidae is recorded in the state.

Key words: Amphibia, Atlantic Forest, Rio dos Sinos

The genus *Friztiana* Mello-Leitão, 1937, which is characterized by females that carry eggs in an open basin on the dorsum (Duellman and Gray 1983), has four recognized species: *F. goeldii* (Boulenger, 1895), *F. ohausi* (Wandolleck, 1907), *F. ulei* (Miranda-Ribeiro, 1926), and *F. fissilis* (Miranda-Ribeiro, 1920). These four species are all from the Atlantic Forest of southeastern and southern Brazil (Duellman 1977; Folly et al. 2014; Haddad et al. 2013). *Fritziana fissilis* (= *Flectonotus fissilis*) inhabits bromeliads in humid mountain and foothill forests between 500 and 1800 m above sea level, and were previously recorded from the states of Santa Catarina, Paraná, São Paulo, Rio de Janeiro and Espírito Santo (Frost 2014; Haddad et al. 2013; Kwet and Márquez 2010). This region, the Atlantic Forest *stricto sensu* (Floresta Ombrófila Densa, in Portuguese), has its southern limit in the eastern and northeastern portions of the Brazilian state of Rio Grande do Sul and occurs in mountains and adjacent coastal lowlands (Teixeira et al. 1986). Rio Grande do Sul has 104 species of amphibians (Colombo et al. 2010) and approximately 80% of the threatened species are restricted to the Atlantic Forest (State Decree 51,797, September 8, 2014; Garcia and Vinciprova 2003). We present here the first record of *Fritziana* aff. *fissilis* from Rio Grande do Sul.

Since January 2014, monthly expeditions have been performed to the region of the sources of the Rio dos Sinos, municipality of Caraá, state of Rio Grande do Sul, Brazil. These aim to survey the local amphibian composition. On 14 January 2014, about 22:00 h (air temperature 20°C, sky cloudy), we recorded an unidentified call. Two males of *Fritziana* aff. *fissilis* vocalized from inside bromeliad *Vriesea platynema* Gaudich. One of the individuals was recorded and later captured 2.40 m from the ground, approximately 35 m from the river course (29°42′11″ S, 050°17′36″ W, 448 m above sea level; Figure 1). The specimen was examined, photographed (a photo sample was archived at AmphibiaWeb) and released. The species was not recorded between February and August of that year. On 30 September 2014, about 21:00 h (air temperature 24°C, sky open), an adult male was collected in the same local (Figure 2). The species was recorded in the subsequent months of October, November, and December. The forest here—either original or in an advanced successional stage—has a canopy 9–14 m high and is composed mostly by Atlantic Forest plant species such as the slender palms *Euterpe edulis*, *Geonoma gamiova* and *Bactris setosa*. A typical regional feature is also the hilly landscape, rich in exposed basaltic rocks along the riparian slopes.

Advertisement calls were recorded using a Tascam DR-100 with the internal microphones (frequency response of 20 Hz – 22 kHz; sampling frequency of 48 kHz, 24-bit). A sample of the recordings was archived at the Macaulay Library (Cornell University). Recordings were analyzed using Raven Pro 1.5 (Bioacoustics Research Program 2014), measuring the following parameters in the spectrograms and oscillograms: length (delta time), peak frequency (the frequency at which peak/max power occurs), high frequency, low frequency, center

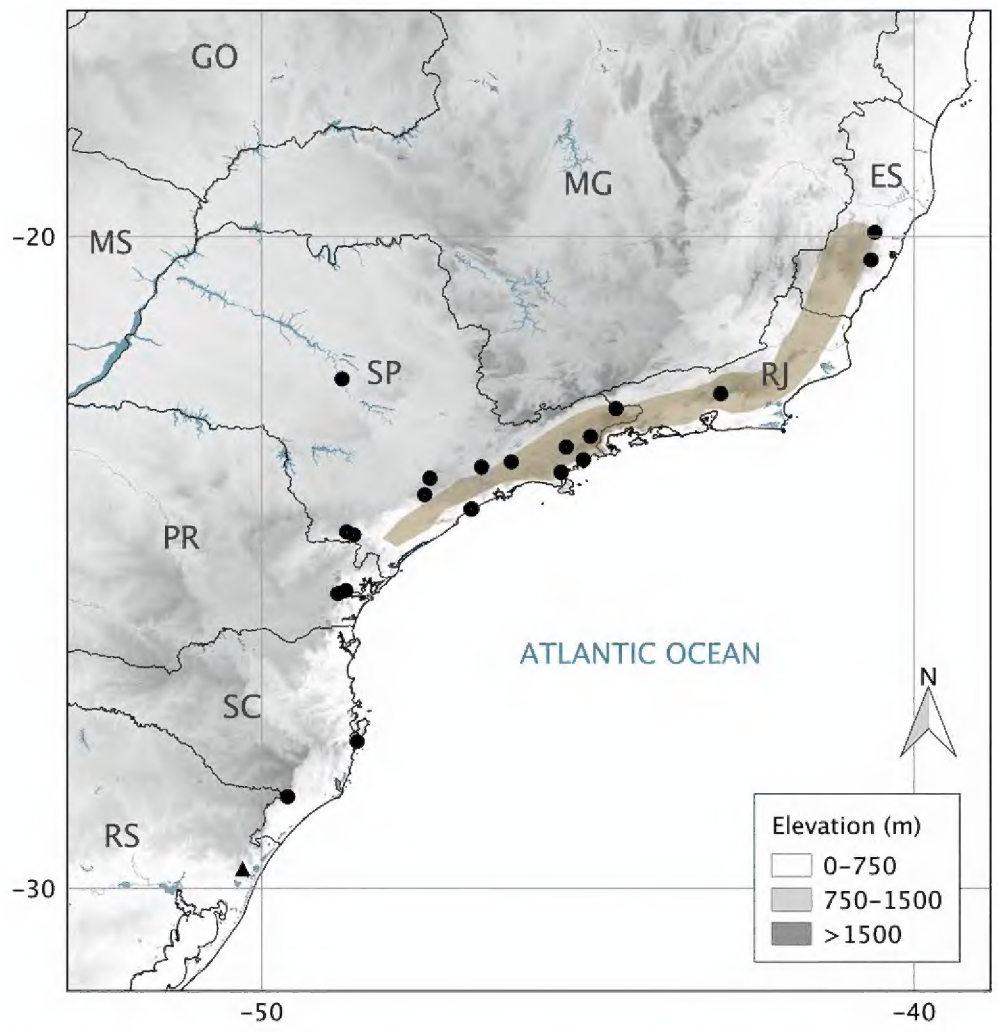

Figure 1. Localities with records of *Fritziana fissilis* in southeastern/south Brazil (including the southern *F.* aff. *fissilis*). Brown buffer: distribution according to Carvalho-e-Silva and Telles (2010); circles: known localities (see Appendix 2); triangle: the new area in the state of Rio Grande do Sul.

frequency and peak power for each phrase (entire call), further the number of notes per call/phrase and duration of intervals. The spectrogram/oscillogram figure was made using the R (R Development Core Team 2014) package Seewave (Sueur et al. 2008). Values of the measured parameters were compared between the collected data and the vocal analyses of Duellman and Gray (1983; KU Tape #1361, from Rio de Janeiro) and, additionally, with the recordings of *Fritziana* aff. *fissilis* by Kwet and Márquez (2010; from Santa Catarina). External morphology was qualitatively compared between the examined specimens and some collection specimens (Appendix 1) and literature, e.g., Duellman and Gray (1983), the redescription of *F. fissilis* by Bokermann (1950), and the species key of Folly et al. (2014). Values are presented as means ± standard deviations (min.–max.).

The advertisement call of *Fritziana* aff. *fissilis* was composed by six to ten notes (modal value: eight), with total length of 0.54 ± 0.07 (0.47–0.73) s, 3,166.66 ± 112.67 (3,000–3,375) Hz of peak frequency, 4,075.1 ± 133.99 (3,933.3–4,337.3) Hz of high frequency, 2,181.82 ± 88.84 (2,054.7–2,313.3) Hz of low frequency, 3,145.83 ± 82.67 (3,000–3,187.5) Hz of center frequency and 140.68 ± 2.42 (137.2–144.1) dB of peak power (n = 9; Figure 3). The time interval between each call/phrase emission was 47.03 ± 13.63 (32.08–58.76) s (n = 3). The amplitude increases from the first to the last notes, being the last three the higher. Each note was composed by one to four pulses (modal value: three), descending, ascending or with no variation in amplitude (Figure 3). Comparing these values with recordings of calls from southeastern populations (Duellman and Gray 1983), we found differences in frequency intervals (respectively, 2,000–4,300 Hz *vs.* ~2,000–3,000 Hz) and "fundamental"/peak frequencies (3,200 Hz *vs.* 2,400 Hz). We didn't find any differences between these values and the recordings of Santa Catarina populations (Kwet and Márquez 2010).

This is the first species of the family Hemiphractidae occurring in the state of Rio Grande do Sul. The present record extends the geographic range of *Fritziana fissilis* 140 km to the south (considering Siderópolis, SC,

Figure 2. Adult male *Fritziana* aff. *fissilis* (UFRGS 7068, SVL: 21.1 mm) from municipality of Caraá, Rio Grande do Sul, Brazil, in life. Photo: Márcio Borges-Martins.

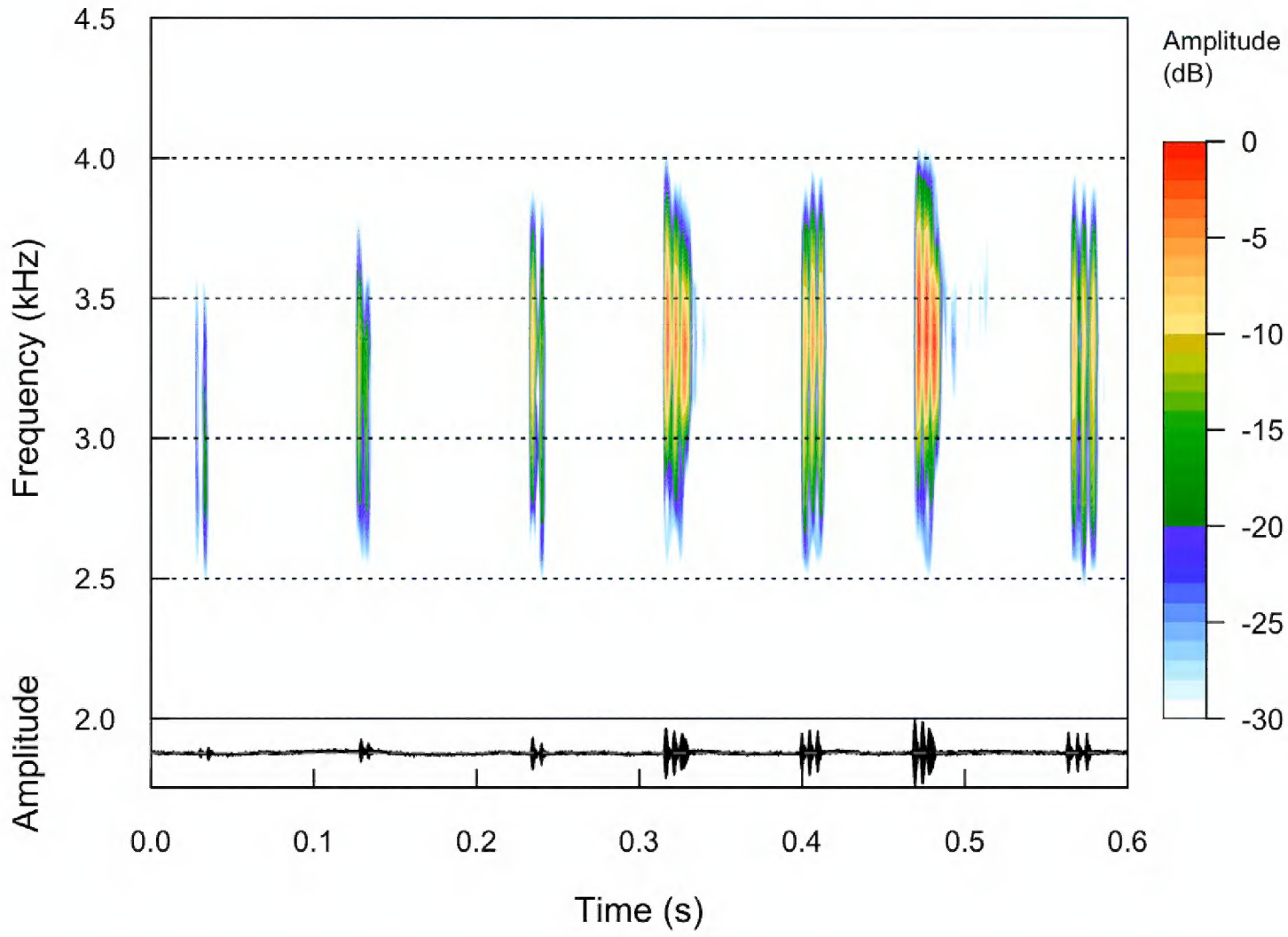

Figure 3. Spectrogram and oscillogram of a call (ML 175699) of an adult male *Fritziana* aff. *fissilis* (not collected) from municipality of Caraá, Rio Grande do Sul, Brazil. Access URL: http://macaulaylibrary.org/audio/175699.

as the previously known southernmost site). This is also is the southernmost limit of occurrence of the genus *Fritziana*. The only published record of the species from Santa Catarina is that of Kwet and Márquez (2010), from Florianópolis (280 km from Caraá, RS). The specimens from Siderópolis are just from collection (UFRGS 6594, 6611). We expected this occurrence closer to the state of Santa Catarina, which includes well-studied areas (e.g., Pró-Mata, São Francisco de Paula, Kwet et al. 2010; and Parque Estadual de Itapeva, Torres, Colombo et al. 2008), and demonstrates the importance of new studies in poorly known areas, especially in the Atlantic Forest *stricto sensu* of Rio Grande do Sul. Although the study area is legally protected (Brazilian law 12,651, "Código Florestal") by its location in a region of water sources, having slopes greater than 45°, and is within the Área de Proteção Ambiental de Caraá (a non-restrictive category of conservation unit), we highlight the need for additional means to guarantee protection of these southernmost portions of the Atlantic Forest and its biodiversity. Other organisms that also depends of this type of vegetation formations and landscape conditions will likely reach their southernmost limits in this region. The region of the sources of the Rio dos Sinos is on the southern slope of the Serra do Mar coastal forests and can be effectively connected through this forest chain to some national and regional protected areas.

The treatment *Fritziana* aff. *fissilis*—as used by Kwet and Márquez (2010) to mention southern populations and recently by Padial et al. (2014) for an "unnamed species"—is adopted here and reflects the similarity (external morphology and vocalization) found between the recorded specimen with the comparative material examined and literature. The collected specimen (UFRGS 7068, Figure 2) presents the bifid subarticular tubercules on fingers III and IV, which are considered a diagnostic character of *Fritziana fissilis* (Folly et al. 2014). We do not reject the possibility that this is a currently undescribed taxon. An important indication of the distinction between the southern *Fritziana* aff. *fissilis* and the southeastern *Fritziana fissilis* was the apparent difference found in the advertisement calls, although only two individuals from the south have been recorded. Another problem is that *F. fissilis* and *F. ulei* occurs in sympatry (Folly et al. 2014), so it is not possible to attribute the recordings used by Duellman and Gray (1983), from Rio de Janeiro, to the first species. The vocal differences found could only be an unknown distinction of *F. fissilis vs. F. ulei*. Obtaining specimens, tissues and more recordings is crucial for a proper assessment of the taxonomic status of this new population of *Fritziana* from the southern limit of the genus.

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Appendix 1. Material examined (all from Brazil).
Fritziana aff. *fissilis*. RIO GRANDE DO SUL: UFRGS 7068 (Caraá, 30/09/2014). SANTA CATARINA: UFRGS 6611 (Siderópolis, 16/08/2013); UFRGS 6594 (Siderópolis, 28/06/2013).
Fritziana goeldii. RIO DE JANEIRO: UFRGS 350 (Tijuca, 15/02/1964).

Appendix 2. Geographic coordinates from the localities with records of *Fritziana fissilis* (including the southern *F.* aff. *fissilis*) used in the map (Figure 1), obtained from collection specimens (consulting the SpeciesLink; http://splink.cria.org.br). Such specimens were not analyzed by us in order to confirm the identity and therefore this is responsibility of the curators.
SANTA CATARINA: municipality of Siderópolis, 28°35′32.01″ S, 049°34′56.43″ W (UFRGS 6594, 6611); municipality of Florianópolis, 27°44′31.28″ S, 048°32′20.13″ W (MCP 8283, 8284). PARANÁ: municipality of Morretes, 25°28′37″ S, 048°50′04″ W (DZSJRP 5251); municipality of Antonina, 25°25′43″ S, 048°42′43″ W (CFBH 11106). SÃO PAULO: municipality of Piedade, 23°42′36″ S, 047°25′12″ W (CFBH 23316); municipality of Intanhaém, 24°10′48″ S, 046°46′48″ W (CFBH 12205); 24°10′59″ S, 046°47′20″ W (DZSJRP 599); 24°10′48″ S, 046°46′48″ W (CFBH 22113); 24°10′48″ S, 046°46′48″ W (CFBH 22143); 24°10′48″ S, 046°46′48″ W (CFBH 8333); 24°10′59″ S, 046°47′20″ W (SINBIOTA C11010T97612); municipality of São Paulo, 23°32′24″ S, 046°37′48″ W (CFBH 13572); 24°10′59″ S, 046°47′20″ W (DZSJRP 600); municipality of São Luís do Paraitinga, 23°13′59″, 45°19′59″ W (SINBIOTA C10319T87403); 23°13′59″ S, 45°19′59″ W (SINBIOTA C10335T88177); municipality of Cunha, 23°04′12″ S, 044°57′36″ W (CFBH 12194); municipality of Tapiraí, 23°57′36″ S, 047°30′ W (CFBH 10315); municipality of Caraguatatuba, 23°37′12″ S, 045°24′36″ W (CFBH 8273); 23°37′13″ S, 045°24′35″ W (ZUEC 3921); municipality of Boracéia, 22°11′24″ S, 048°46′12″ W (CFBH 1557); 22°11′24″ S, 048°46′12″ W (CFBH 1558); municipality of São José do Barreiro, 22°38′24″ S, 044°34′11″ W (ZUEC 942); 22°38′24″ S, 044°34′11″ W (ZUEC 943); municipality of Iporanga, 24°34′48″ S, 048°35′24″ W (CFBH 6301); 24°31′59″ S, 048°42′ W (SINBIOTA C10092T86228); municipality of Ubatuba, 23°25′48″ S, 045°04′12″ W (CFBH 4542); 23°25′48″ S, 045°04′12″ W (CFBH 19955); municipality of Santo André, 23°46′15″ S; 46°17′30″ W (CFBH 28980); municipality of Ilhabela, 23°50′45.77″ S, 045°19′17.70″ W (CFBH 17496). RIO DE JANEIRO: municipality of Teresópolis, 22°24′44″ S, 042°57′56″ W (DZSJRP 598). ESPÍRITO SANTO: municipality of Santa Tereza, 19°56′09″ S, 040°36′01″ W (ZUEC 8900); municipality of Domingos Martins, 20°21′48″ S, 040°39′33″ W (MBML 7235).